West VAMP
BHPB Illawarra Coal

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BHP Billiton – Global Operations

Petroleum

Aluminium

Base Metals

Energy Coal

Diamonds & Spec Prod

Stainless Steel Materials

Metallurgical Coal

Manganese

Iron Ore

Note: Location of dots indicative only

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BHP Billiton Climate Change Policy

BHP BILLITON
CLIMATE CHANGE POLICY

OVERVIEW

BHP Billiton believes that the risks of climate change associated with increasing greenhouse gas concentrations in the atmosphere need to be addressed through accelerated action. The actions should aim to stabilise concentrations at levels guided by the research of the United Nations Intergovernmental Panel on Climate Change. Behavioural change, innovation and technological progress are necessary to achieve stabilisation in a manner consistent with meeting natural resource and energy needs. Building on our earlier efforts, we will take action within our own businesses and work with governments, industry and other stakeholders to address this global challenge and find lasting solutions consistent with our goal of Zero Harm.

Our actions focus on four areas:

1. Understanding emissions from the full life cycle of our products.
2. Improving the management of energy and greenhouse gas emissions across our businesses.
3. Committing US$300 million over the next five years to support low emissions technology development, internal energy excellence projects and encourage emissions abatement by our employees and our local communities.
4. Using our technical capacity and our experience to assist governments and other stakeholders on the design of effective and equitable climate change policies including market-based mechanisms such as emissions trading.

BHP BILLITON'S ACTION PLAN

1. Increase understanding of life cycle emissions of our products

It is essential that we understand the sources, scope and extent of greenhouse gas emissions associated with our activities:

- We will continue transparent public reporting of our emission profile, including our emissions from production activities, the use of our fossil fuel products by our customers, and the actions we undertake to manage and mitigate emissions.
- We will work with experts to improve our understanding of the full life cycle of our products and strategies for effectively reducing greenhouse gas emissions from their production and use.

2. Improve management of energy and greenhouse gas emissions from production

Some of our businesses are among the most energy efficient in the world. We build on this leading practice within the Group, using external standards of excellence, to continually improve energy and greenhouse gas management at our sites. Emissions abatement and energy saving considerations are built into our decision-making processes, through:

- **Business excellence** – Our business excellence systems promote and share leading practice and innovation in energy and operational efficiency to deliver savings in emissions and costs.
- **Group targets** – We have set energy and greenhouse gas emissions intensity reduction targets of 13 and 6 per cent respectively for the Group over the period 2006-2012.
- **Site based plans and targets** – Every site is required to have a greenhouse gas and energy management plan, including targets that are incorporated into their business plans with associated monitoring and reporting.

1. Improving our understanding of product life cycle emissions
2. Reducing emissions and energy intensity of our operations
3. Funding low emissions technology development
4. Provide technical advice to assist policy makers


Image NASA
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West VAMP – Business case and context

- Investment of $A30M
- GGAP (Australian Federal Government) Grant $A6M
- Revenue streams from
  - NSW Government Greenhouse Gas Abatement Scheme (NGACs)
  - Avoided Electricity Costs to West Cliff Mine.
- Decrease frequency of electricity interruption to critical mine assets

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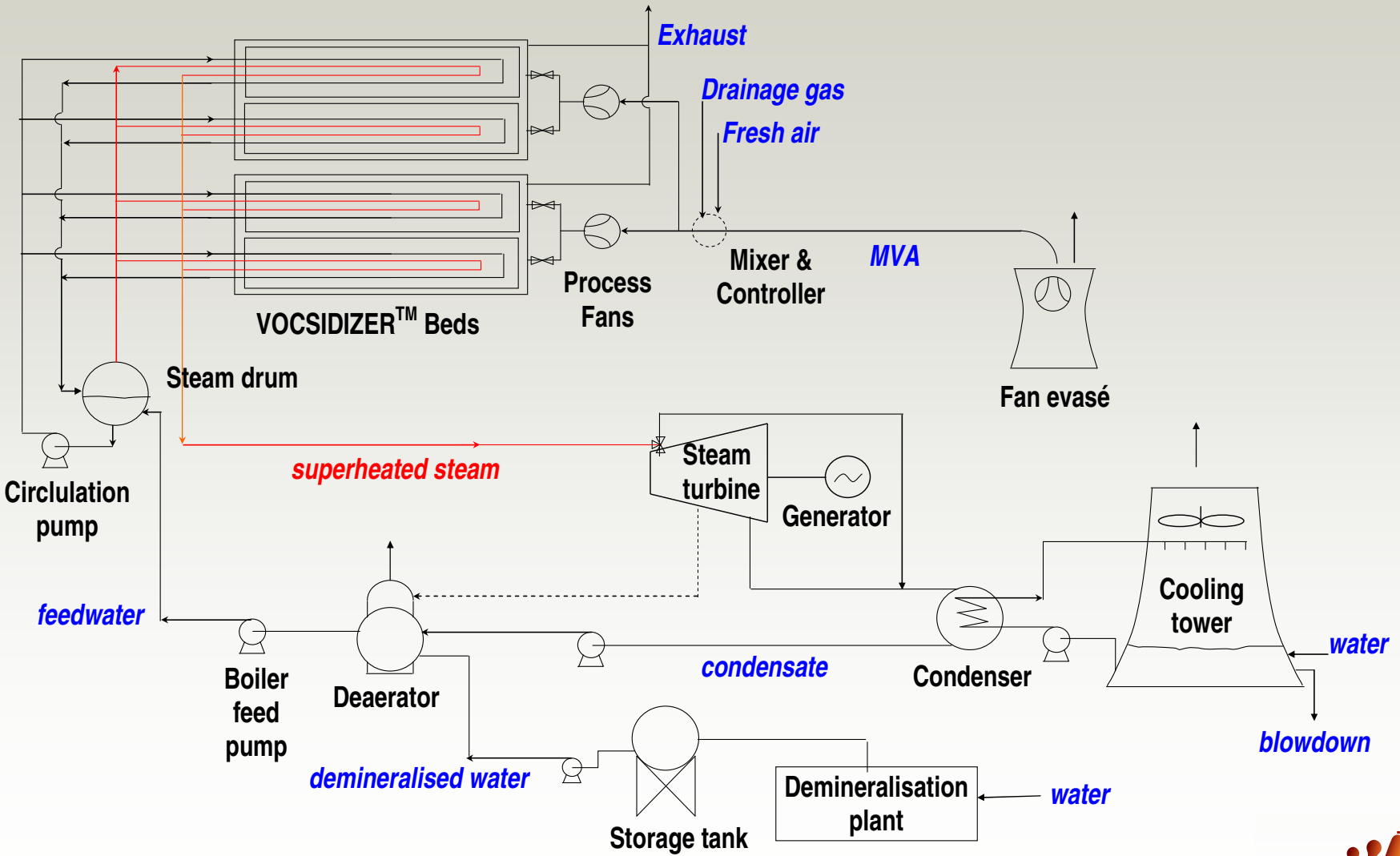
WestVAMP - Simplified Flow Sheet



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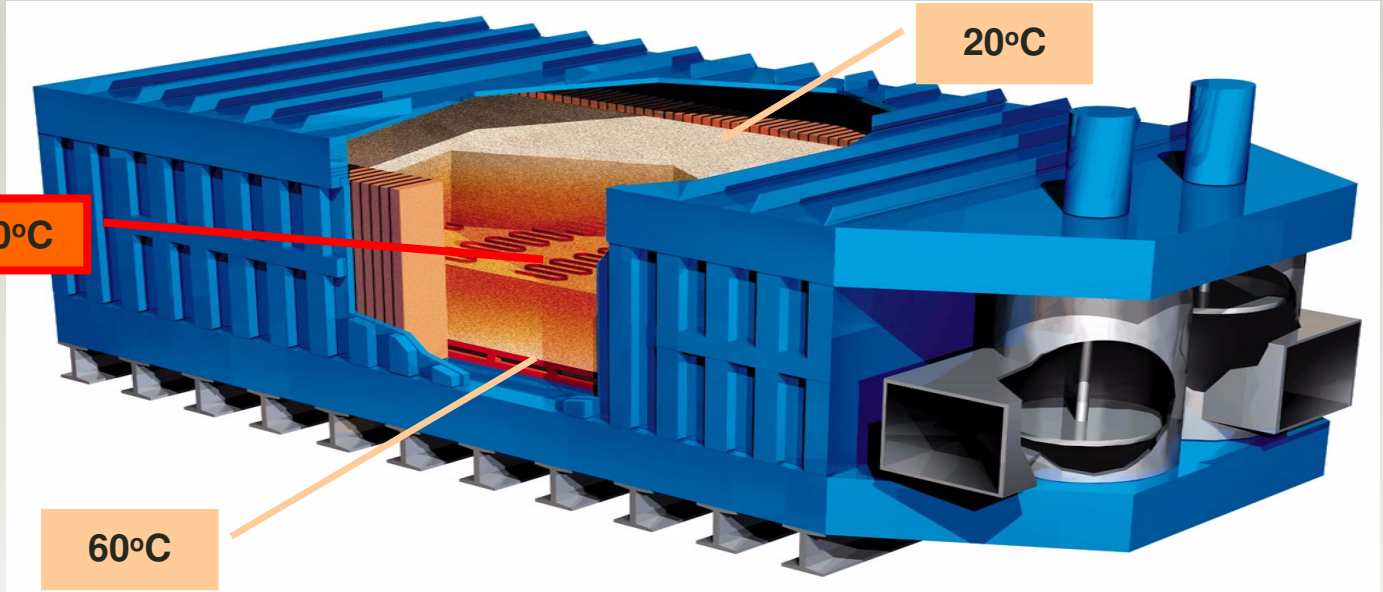
VOCSIDIZER™ – Flameless Oxidation Of Methane



- Flameless: Oxidation completely in-bed.
- No NOx: No flame / low temperature. Homogeneous temp distribution without peaks.
- Start-up: Heating elements in centre of ceramic bed.
- Heat efficient: Self sustaining at low concentrations (0,1% of methane).

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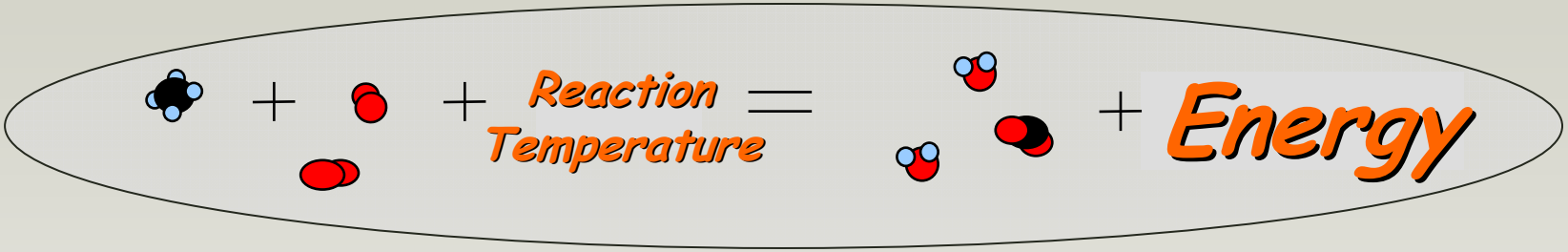
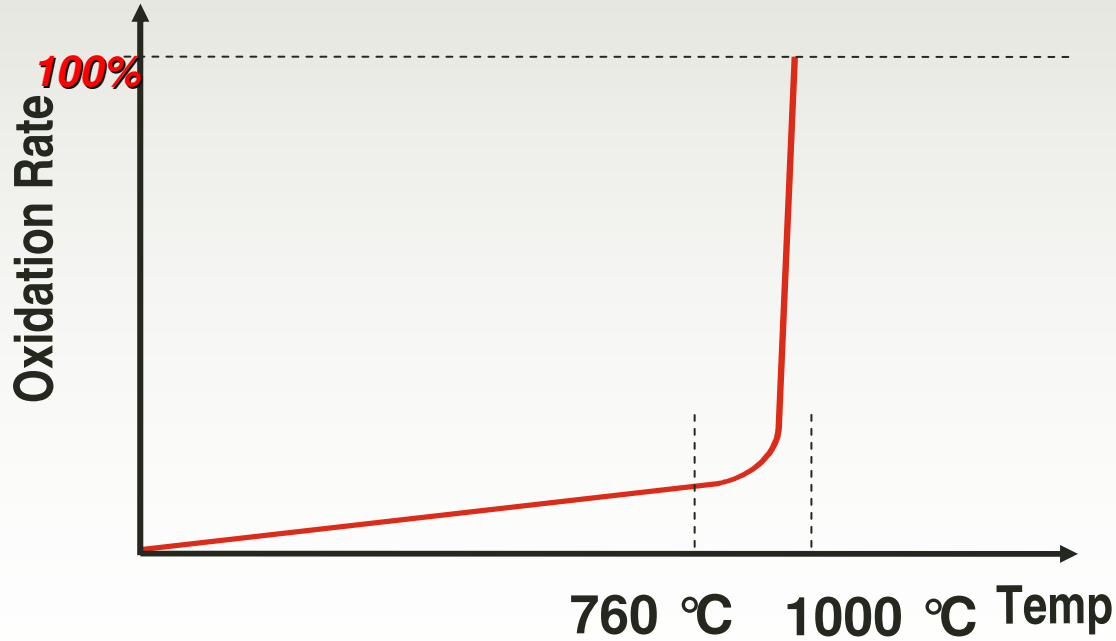
VOCSIDIZER™ - Principle of Reaction



- Like all Volatile Organic Compound (VOC) gases, methane oxidises at 850-900°C, to form mainly water and CO_2.



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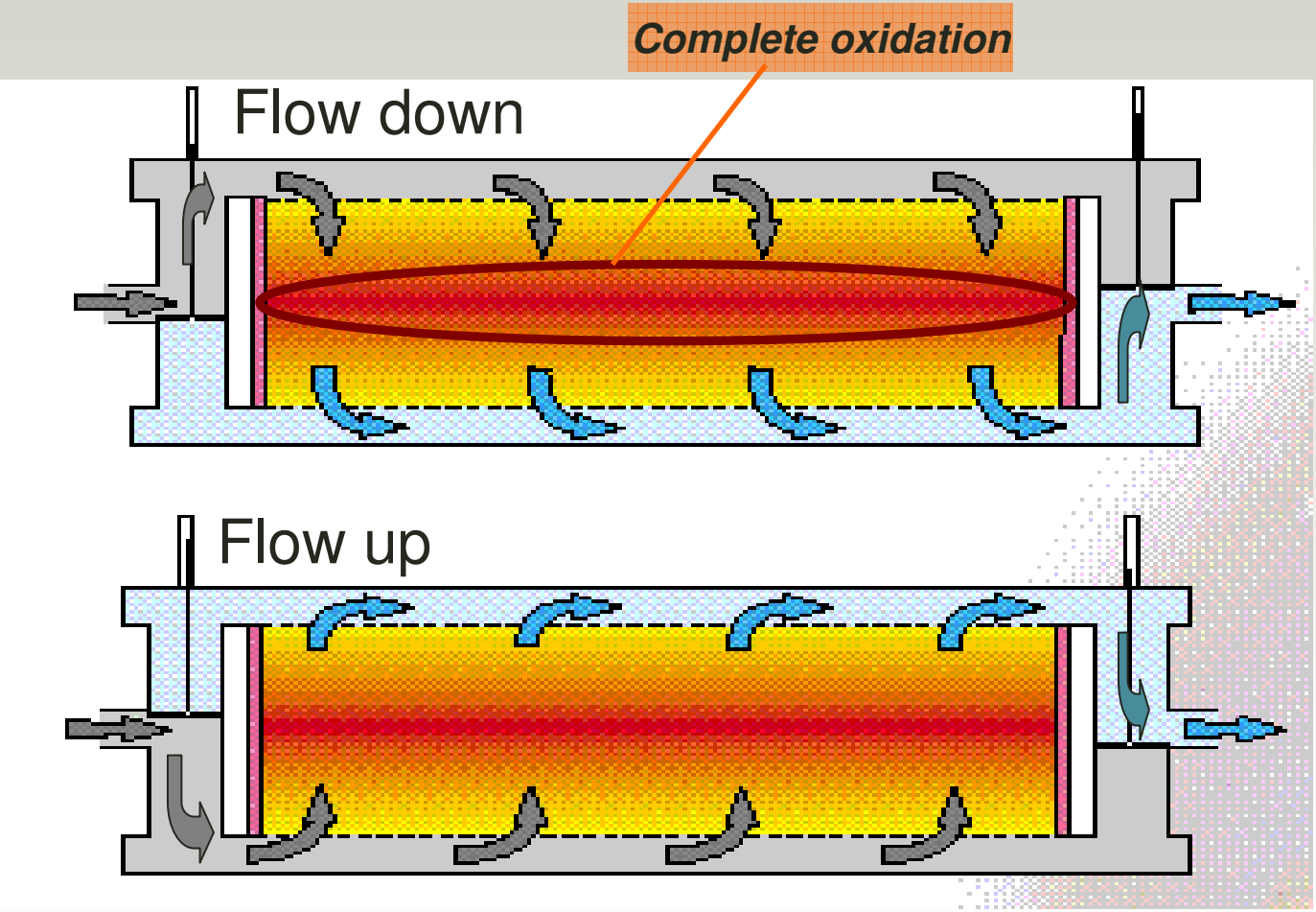
VOCSIDIZER™ - Operation



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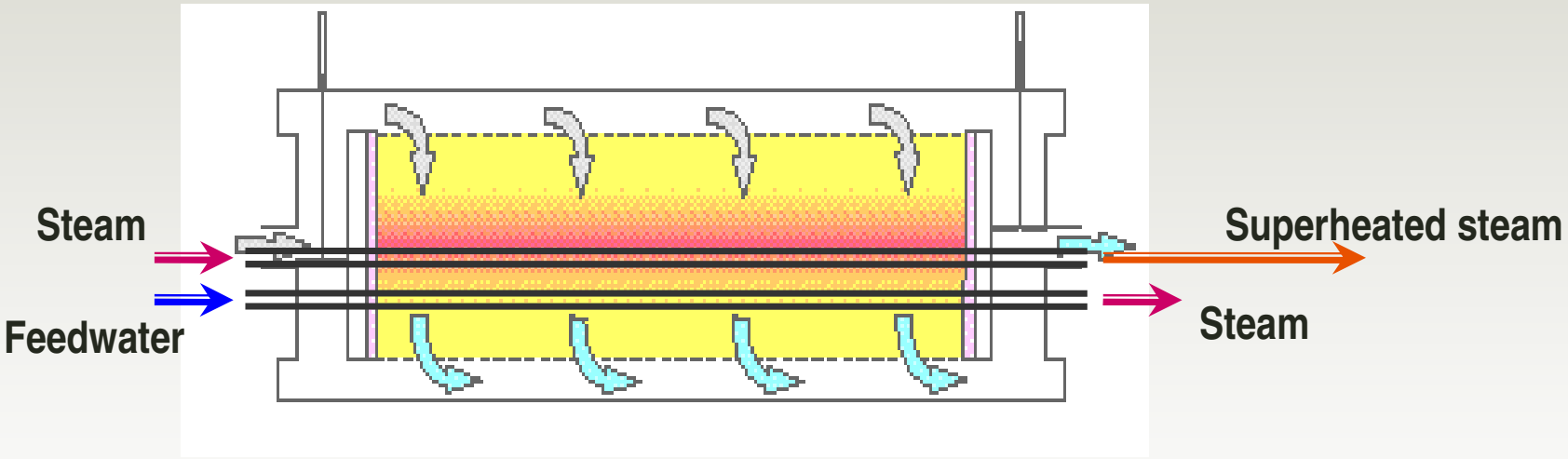
Recovering Energy From the WestVAMP VOCSIDIZER™ Beds



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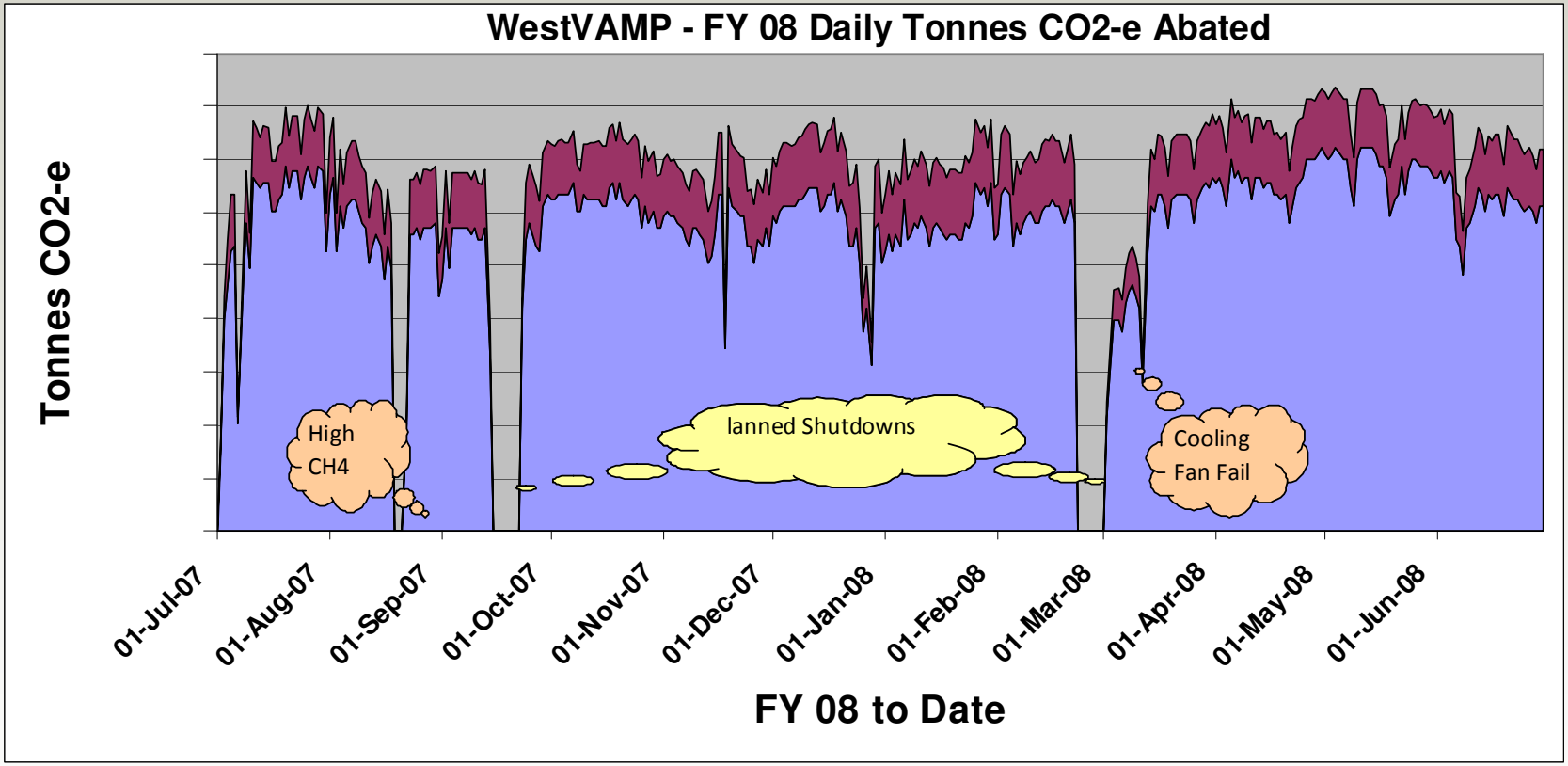
West VAMP Operations – GHG Abatement



Direct Methane Emissions Avoided (Blue) = 250,000 t CO2-e

Electricity Emissions Avoided (Purple) = 45,000 t CO2-e

Total Emissions Avoided to date = 295,000 t CO2-e

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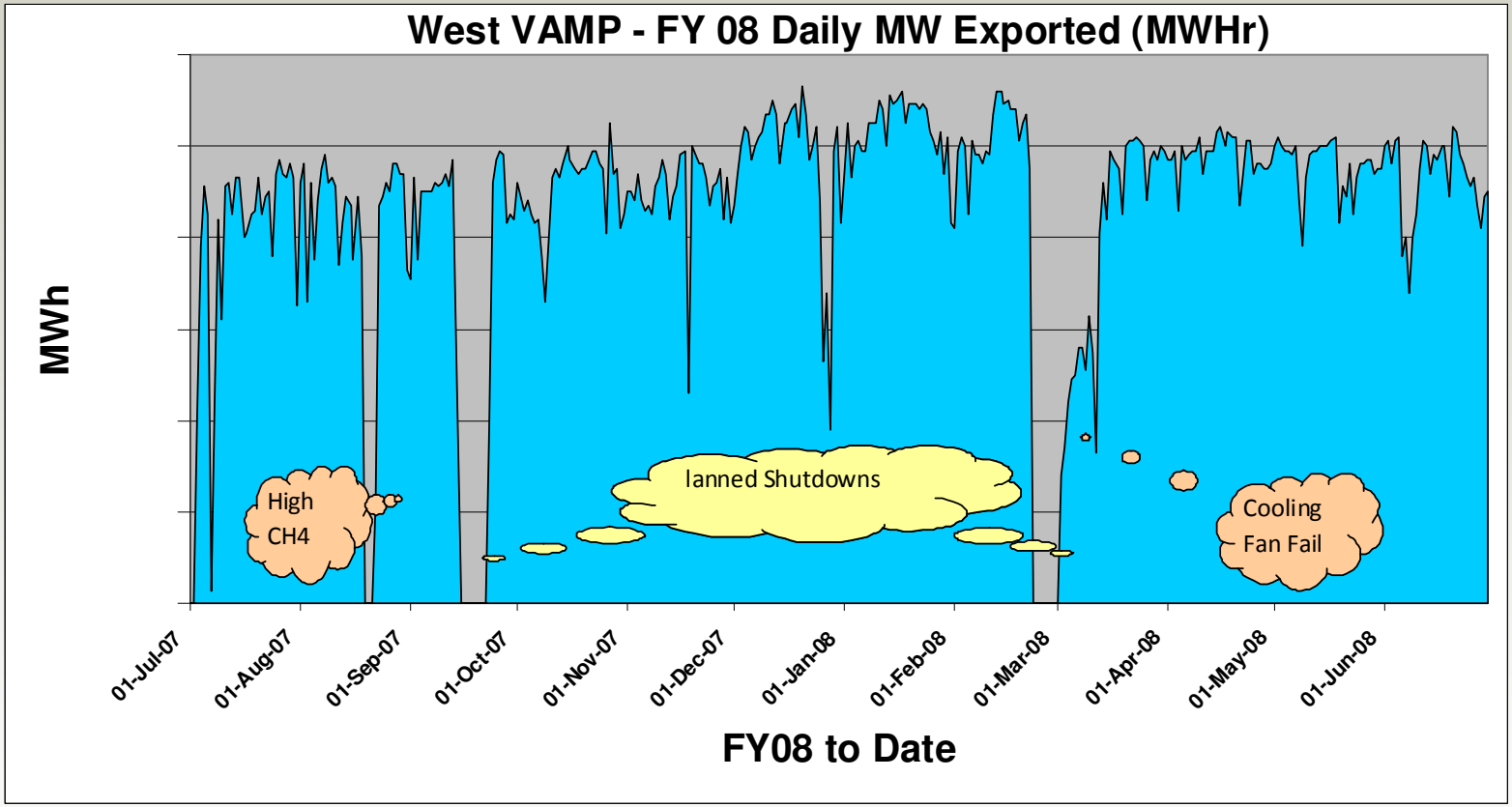
West VAMP Operations – Electricity Generation



Since Commissioning in Feb 2007 (to end June 2008)

Gross Generation = 50 GWh

Net Exported Electricity = 40 GWh

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WestVAMP - Plant View

West VAMP Operations – Lessons / Technical Issues

VAM inlet connection design

- Air gap to main fans
- Dust and fines control
- Power requirements

Fuel (Methane concentration) control suffers from drift of methane sensor accuracy

- Aggressive Environment (High Velocity, Humidity, Dust)
- Real Time Sensor Technology (Immediate) versus Analyser Technology (Sample delay)
- Repeatability in variable flow, temperature, and humidity environment ?
- Variable Temperature (Due to Fuel Control)
- Temperature influences steam production
- Steam production influences electricity generation

Material Selection

- In service duty very high temperatures
- Material selection for extended thermocouple life (greater than 6 months) or alternate measurement

Process Safety - Operational Reliability – a fine balance

- New installation, new application of technology – Therefore **Safety First**

Mine site, GHG Abatement Facility or Power Plant ?

- Define jurisdiction early

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Australian Carbon Pollution Reduction Scheme

- Cap and Trade commencing 2010
- Broad Coverage – Coal Mining (Both UG and OC) Included
- Fugitive emissions (CMM) included in GHG inventory
- NGER mandatory reporting scheme from July 2008
- Included emissions will require permit to be acquitted
- Permits to be acquired via an auction process
- Currently no plan for incentive for power generation
- Australian coal operators will look to reduce exposure (quickly)
- Expect staged increase in energy costs

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VAM – Next challenges

- Higher volume , high velocity mine air flow (+ 600 m^3/sec)
- Connection to mine main fans
- Dust control
- Orientation and packaging of units
- Staged approach to GHG abatement whilst allowing energy recovery
- Project execution speed

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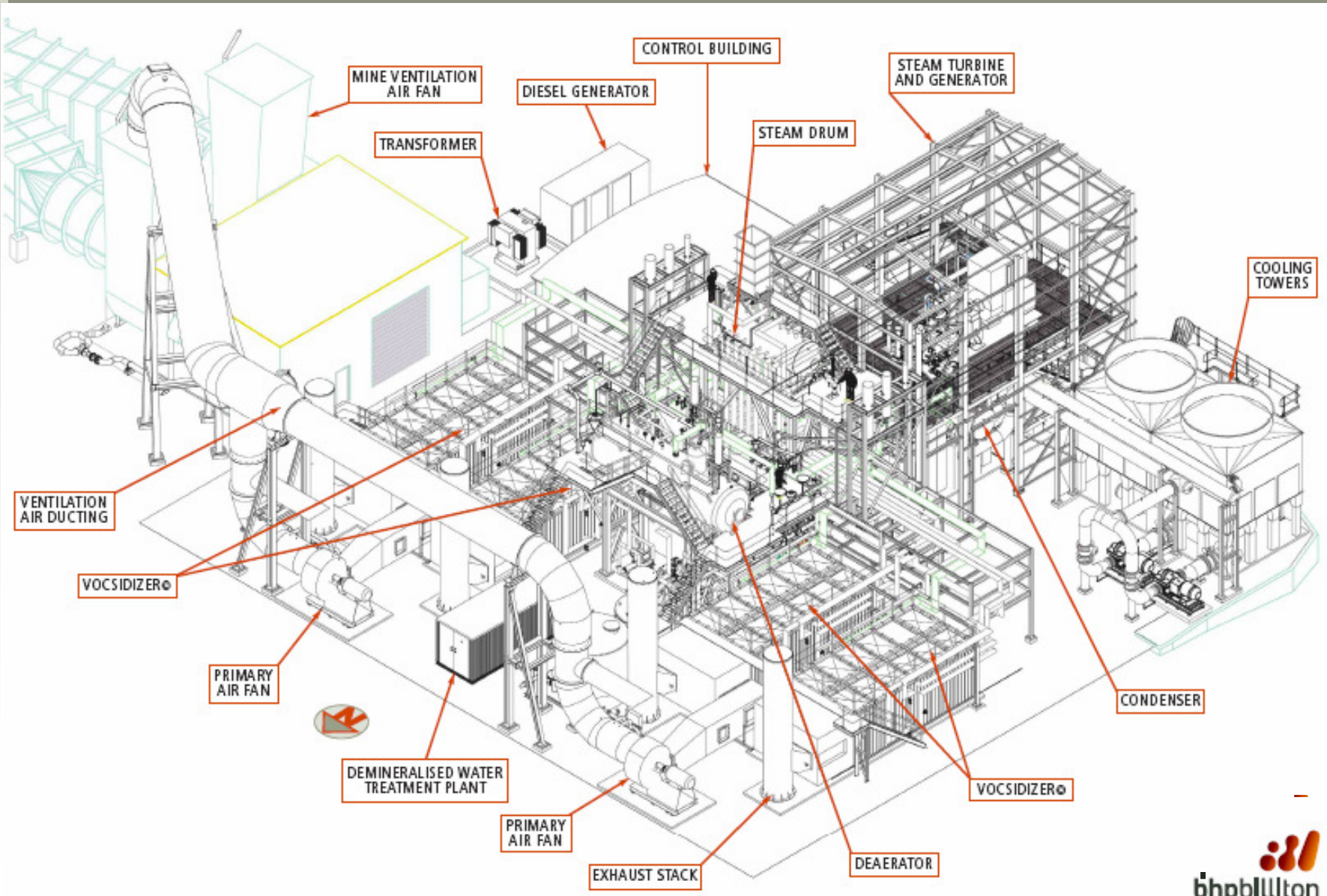
Plant Layout



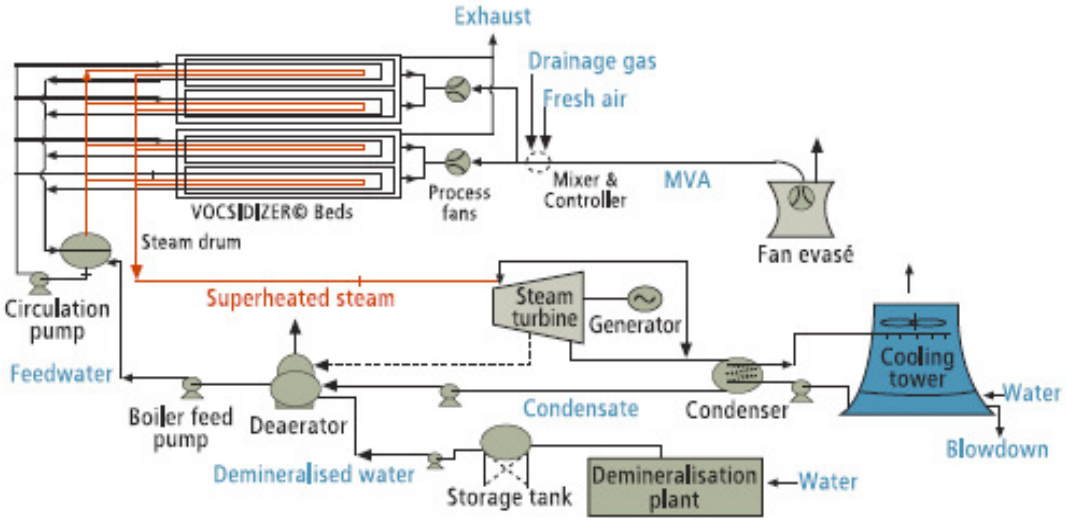
West VAMP – Plant Overview

The BHP Billiton Illawarra Coal West Cliff Ventilation Air Methane Project (WestVAMP) uses the extremely dilute methane in the ventilation air from West Cliff Mine to generate electricity and reduce greenhouse gas emissions.

The technology is based on the VOCSIDIZER© technology designed and developed by Swedish emission control specialist MEGTEC Systems AB.

WestVAMP converts low concentration methane to carbon dioxide and water vapour through an oxidation, or flameless combustion process. High efficiency heat exchangers recover the large levels of thermal energy released to produce high quality steam.

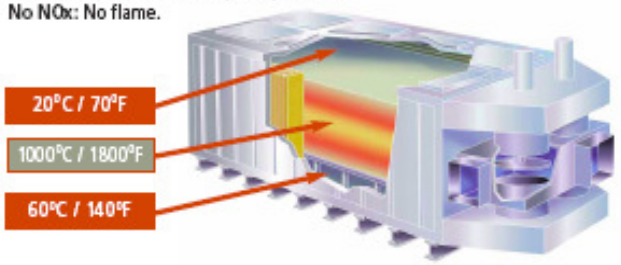
This steam is used to drive a conventional steam turbine, which generates five megawatts of electricity for use within the West Cliff mine.



VOCSIDIZER©

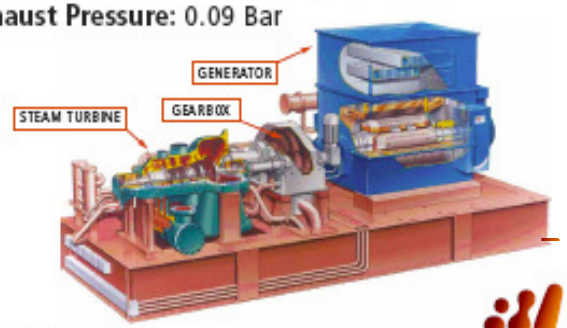
- **Operating Range:** 0.3 – 1.0 per cent CH_4 in air
- **Flow rate per unit:** 140,000 Nm3/hr
- **Centre bed temperature:** 1100°C
- **Inlet air temperature:** 25°C
- **Exhaust temperature:** 65°C
- **CO_2-e tonnes abated:** 220,000 tonnes per year

Flameless: Oxidation completely in-bed.
No NOx: No flame.



STEAM TURBINE GENERATOR

- **Gross electrical power output:** 5.8MW
- **Turbine speed:** 10,000 rpm
- **Inlet Steam Conditions:** 450°C temperature
  58 Bar pressure
  6.5 kg/s flow
- **Exhaust Pressure:** 0.09 Bar



Model: Siemens ST3-V28A
Condensing steam turbine

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